

SECTION 15030

ADJUSTING, BALANCING AND SYSTEM TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

1.2 WORK INCLUDED

- A. Prebalance of existing air handling units prior to start of any demolition.
- B. Checking installation for conformity to design.
- C. Checking each piece of equipment for proper installation and operation.
- D. Balance of air and water distribution systems including adjustment and measurement. Domestic hot water recirculation systems shall be balanced under this section.
- E. Electrical measurement.
- F. Verification of performance of all equipment and automatic controls.
- G. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.
- H. Recording and reporting results.

1.3 REFERENCES

- A. Air Diffusion Council (ADC) 1062R3 Equipment Test Code.
- B. Associated Air Balance Council (AABC) National Standards for Field Measurements and Instrumentation, Total Balance System Balance, Air Distribution - Hydronic Systems, Volume 1.
- C. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

1.4 SUBMITTALS

- A. Submit in accordance with General Conditions, Division 1 Sections and Section 15000, "MECHANICAL GENERAL PROVISIONS".
- B. Submit test and balance personnel qualifications.
- C. Submit complete description of procedures to be used prior to beginning of any balancing.
- D. Submit design review report within 45 days after contract award.

- E. Submit Test and Balance Report including schedules of test data readings.

1.5 QUALITY ASSURANCE

- A. Adjusting, balancing and testing procedures and compilation of test data shall be performed by a Certified Test and Balance Engineer or by personnel trained and supervised by a Certified Test and Balance Engineer.
- B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.

1.6 SPECIAL REQUIREMENTS

- A. Testing and balancing contractor shall be an independent contractor under the general contractor. Testing and balancing contractor shall not be associated with the mechanical contractor and shall not report to the mechanical contractor.

1.7 DESIGN REVIEW REPORT

- A. Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the accomplishment of the testing, adjusting, and balancing work requirements of this section or result in unacceptable noise or vibration levels. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.8 TOLERANCES

- A. Balance final fluid flows to within plus 10 percent or minus 5 percent of specified quantities. Establish diversity with Engineer prior to proceeding with balancing.

1.9 PREBALANCE

- A. Perform prebalance (airflow, total static pressure, and motor amperage(s)) on the units listed hereafter prior to any demolition work. Submit prebalance data to Architect.

- 1. Existing RTUs, Glenns & Warsaw Campus.

1.10 GENERAL COMMENTS

- A. Water Balance: Readings from venturi flow meters, or automatic pressure independent flow control devices shall be given highest priority as to accuracy. Where neither is specified pump curves and chiller pressure drops are to be correlated to establish flow. Pressure drop across coils or chillers is to be used to proportion flow. Volt and ampere readings will be used as checks. Temperature data will be used only as a performance check and not for balancing.
- B. Air Balance: Readings from a pitot tube traverse will be given highest priority as to accuracy. Terminal flow as established by velometer or manufacturers cfm/pressure curves will be used to pro-rate air flow. Pressure readings as well as voltage and ampere readings will be used for check purposes only. Temperature readings will be used as a check against performance.

- C. Prior to start of balancing, this Contractor shall review balancing test procedures with the Architect. Contractor shall provide information and assistance as required in cooperation with the test, adjust and balance service.

1.11 ACCEPTABLE TAB CONTRACTORS

- A. Virginia Air Balance & Control Corporation (Norfolk, VA)
- B. Testing Specialties Inc. (Chesapeake, VA)
- C. HVAC Testing Ltd. (Chesapeake, VA)

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.0 TEST AND BALANCE REPORT VERIFICATION

- A. Schedule with Architect, Engineer, and Owner. At the time of final inspection, the Test And Balance (TAB) agency may be required to recheck, in the presence of Engineer representative specific and random selections of data, and water and air quantities recorded in the certified report. Points and areas for recheck shall be selected by the representatives. Selections for recheck will not exceed 20% of the total number tabulated on the report. If random test proves a measured flow deviation of 10% or more from that recorded in the certified report listings, the report will be rejected. At this time all systems shall be readjusted and tested, new data recorded, new certified report submitted, and new inspection tests made, all at no additional cost to the Owner. The TAB agency shall provide the representative with a technician for a maximum of 24 hours in order to verify report data and solve problems.

3.1 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. Review drawings and specifications with regard to adjusting and balancing.
- B. Additional balancing devices which, in the opinion of the Contractor, are required for the adjusting and balancing of the systems should be brought to the Architect's attention in the Design Review Report.
- C. Failure of the Contractor to address such additional means shall not obviate the responsibility of the Contractor to properly adjust and balance the systems.

3.2 WATER BALANCE

- A. Ascertain that piping systems have been cleaned, flushed, drained and properly refilled and that all strainer baskets have been removed, cleaned and properly reinstalled prior to beginning water balancing procedure.
- B. Constant flow pumping system using manual balancing valves and/or butterfly valves with memory stop has been specified for the chilled water and hot water systems.
 - 1. With all balancing devices and valves wide open to coil, read and record pressure drop across each coil.

2. With all balancing devices and valves wide open to coil, read and record pressure drop across each pump. Also read and record pressure drop across pump at shut off. Plot point on submitted pump curve.
 3. If pressure drop across all of the coils exceeds the design and the pump pressure readings indicated a flow in excess of design, the pump impeller may be trimmed. Submit this data to Engineer for early review, before proceeding with balancing to determine if an impeller trim is warranted.
- C. Variable flow pumping systems using manual balancing valves with memory stop have been specified for the chilled and hot water systems.
1. Simulate system diversity by isolating random terminal equipment to approximately match the difference between total connected GPM and pump flow rate. Do not isolate groups at the end, middle, or start of the piping system. Randomly isolate units throughout the system. With balancing devices and valves wide open to the remainder of the terminal units, read and record pressure drop across open coils and across each pump. Also read and record pressure drop across each pump at shut off. Plot point on submitted pump curve.
 2. Redo step one for the terminal units initially isolated with balancing devices and valves wide open while isolating previously balanced terminal coils to simulate system diversity as directed above.
 3. If pressure drop across all of the coils exceeds the design and the pump pressure readings indicated a flow in excess of design, the pump impeller may be trimmed. Submit this data to Engineer for early review, before proceeding with balancing to determine if an impeller trim is warranted.
 4. Do not simulate diversity by balancing all coils to the diversity percentage.

3.3 AIR BALANCE

- A. Check system visually and audibly for leakage and verify filters have been replaced. Proceed with balancing as outlined by AABC or NEBB.
- B. Adjust all air handling apparatus to deliver the specified quantity of air at the specified temperatures to all areas of the building served by air systems.
- C. Determine air volume in ducts by use of pitot tube, and inclined manometer.
- D. Determine air quantity through air devices by use of velometer or flow hood with direct readout meter calibrated in CFM. When using velometer, velometer nozzle shall be as recommended by air device manufacturer. Calculate air quantity based on air device area factors provided by the air device manufacturer. Where manufacturers publish cfm vs. air pressure ratings these may be used as indicators of flow.

3.4 CONTROLS ADJUSTMENT

- A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat or temperature sensor set point and room conditions in each space.

- B. Coordinate onsite meetings during TAB work with the Controls Subcontractor for set point adjustment thru DDC controls.

3.5 TEST DATA SCHEDULES

- A. Submit typewritten schedules of test data readings.
- B. Schedules shall record the specified reading, the first reading taken and the final balanced reading for the following items:
 - 1. Motors:
 - a. Designation.
 - b. Nameplate HP, voltage and full load amperes.
 - c. RPM.
 - d. Motor amperes and voltage under operating conditions.
 - e. For belt drive applications, motor amperes and voltage under no load condition.
 - 2. Fans:
 - a. Designation.
 - b. Nameplate data.
 - c. RPM.
 - d. Static pressure, inlet and discharge.
 - e. CFM from pitot tube traverse of discharge duct.
 - f. Final pitot tube traverse sheets showing all readings.
 - 3. Main and Submain Ducts:
 - a. Designation and location.
 - b. CFM from pitot tube traverse.
 - c. Final pitot tube traverse sheets showing all readings.
 - 4. Terminal Units:
 - a. Designation.
 - b. Nameplate data.
 - c. CFM, maximum setting on regulator.
 - d. CFM, minimum setting on regulator.
 - e. Final pitot tube traverse sheets showing all readings.
 - 5. Air Outlets and Inlets:
 - a. Room designation.
 - b. Type of outlet.
 - c. Design CFM.
 - d. Measured CFM.
 - e. Method of measurement.
 - f. All final measurement readings.
 - 6. Pumps:
 - a. Designation.

- b. Nameplate data.
- c. RPM.
- d. Pressure suction and discharge.
- e. Pressure entering and leaving strainer.

7. Coils - Water:

- a. Designation.
- b. Nameplate data (if available).
- c. Pressure entering strainer valve and leaving flow control service.
- d. Pressure entering and leaving flow control device where two taps are provided.
- e. Temperature entering and leaving water.
- f. Static pressure, entering and leaving air.
- g. Dry bulb and wet bulb temperature, entering and leaving air (4 readings at quarter points where coils are over 20 sq. ft. F.A.)
- h. CFM over coil including all final readings used to obtain cfm.
- i. GPM from flow regulator nameplate.

3.6 OPERATING TESTS

- A. Verification of HVAC control system. The TAB agency shall coordinate with and be assisted by building controls contractor in verifying the operation and calibration of all HVAC and temp control systems. Verify all components are installed in accordance with project requirements and are functional including all electrical interlocks, damper sequences, air and water resets, fire and freezestats and other safety devices.
- B. Operate systems to demonstrate that systems have been properly adjusted and balanced, and to demonstrate that the systems' performance conforms with the intent of the specifications and drawings.
- C. Conduct tests on each system with natural building heating and/or cooling loads for a minimum 4 hours duration.
- D. Conduct tests for one season only. During season not tested, make adjustments as necessary to demonstrate that the systems' performance in season not tested conforms with the intent of the specifications and drawings.

3.7 EQUIPMENT MARKING

- A. Mark equipment settings, including damper control positions, ductwork balancing dampers, valve indicators, fan speed controls and similar controls and devices, to show final settings at completion of T&B work. Provide markings with paint or other suitable permanent identification materials.

END OF ADJUSTING, BALANCING AND SYSTEM TESTING